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AKF

Animal Keepers' Forum

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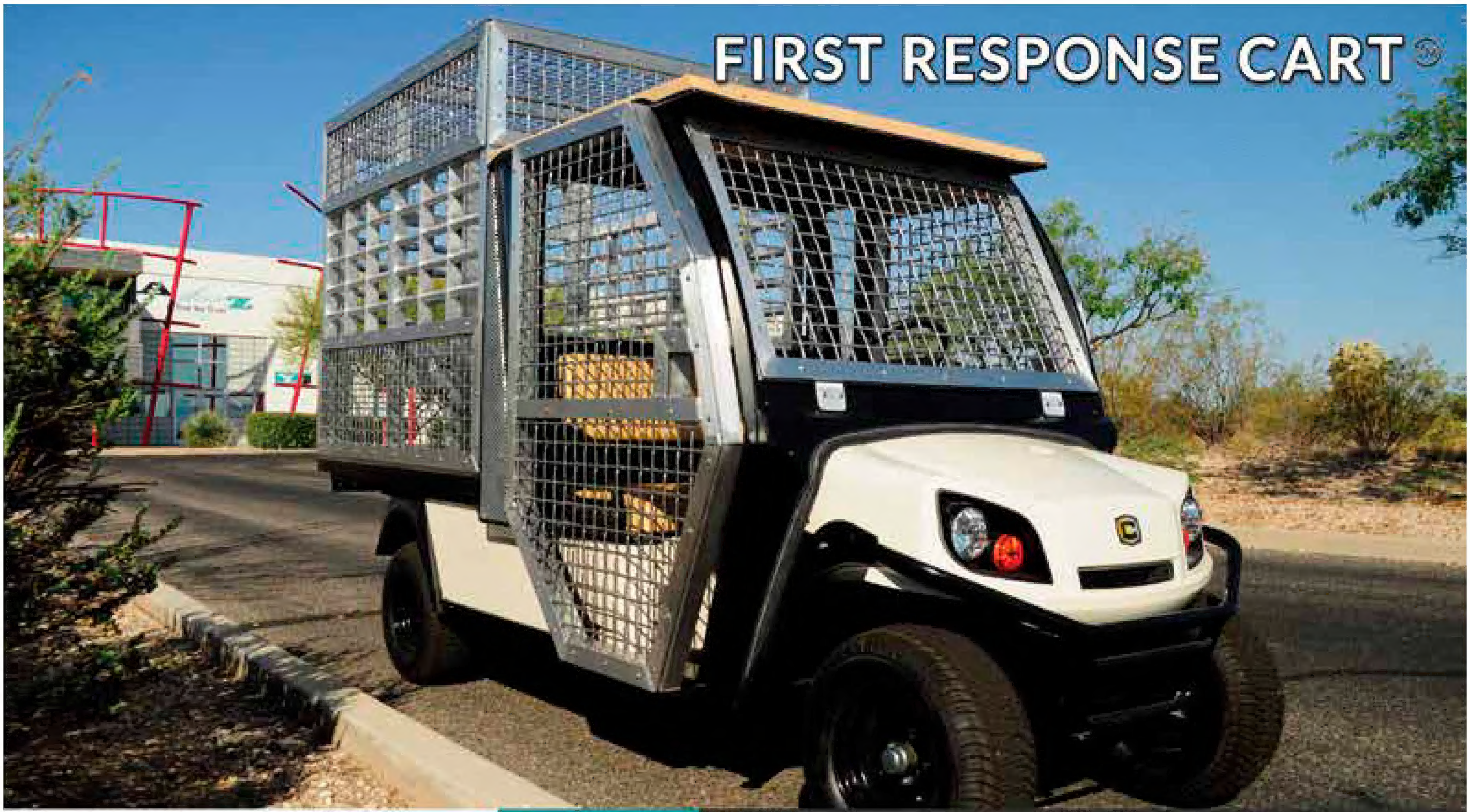

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The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover photo comes to us from Zel MacWilliams of Oglebay Good Zoo and features an adult Eastern hellbender *(Cryptobranchus alleganiensis alleganiensis)*. Other names for these ancient salamanders are "devil dog", "snot otter", and "Allegheny Alligator". These fully aquatic giant salamanders have inhabited rivers for nearly 150 million years, and are considered to be "living fossils" as they've remained largely unchanged. They are the largest salamanders in the Western Hemisphere, living up to 70 years, growing to 2.5 feet in length, and are found throughout the Appalachian area. Hellbenders have lidless eyes, a large flat head, and pronounced lateral skin folds. These folds allow them to literally breathe through their skin! This also means that sediment and pollution in the rivers drastically affect this species. Other threats facing the hellbenders include the illegal pet trade and warming waters due to climate change.

Since 2007, the team at Oglebay Good Zoo has strived to educate students and the community on these living dinosaurs. The zoo also participates in a hellbender head-start program in collaboration with the West Virginia Division of Wildlife, becoming the first in the world to hatch hellbender eggs in a zoo setting. The head-start program now involves around 1,000 animals, being cared for at West Liberty University, The Wilds, and Oglebay Good Zoo.

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

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ANIMAL KEEPERS' FORUM
TO CONTACT THE *AKF* EDITOR:
Shane Good, AKF Editor
P.O. Box 535, Valley City, OH 44280
330-483-1104
Shane.Good@aazk.org

AAZK Administrative Office
American Association of Zoo Keepers
8476 E. Speedway Blvd. Suite 204
Tucson, AZ 85710-1728
520-298-9688 (Phone/Fax)
CHIEF EXECUTIVE/FINANCIAL OFFICER:
Ed Hansen | Ed.Hansen@aazk.org
DIRECTOR of PROFESSIONAL DEVELOPMENT and CONFERENCE MANAGEMENT
Bethany Bingham, Bethany.Bingham@aazk.org

ANIMAL KEEPERS' FORUM - EDITOR
Shane Good, Shane.Good@aazk.org
GRAPHIC DESIGNER
Elizabeth Thibodeaux, Elizabeth.Thibodeaux@aazk.org
ENRICHMENT OPTIONS COLUMN COORDINATORS
Stephanie Miner
Beth Stark-Posta, Beth Ament-Briggs
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AAZK is rolling out a contest rewarding the most successful recruiting Chapter and new or renewing individual members with free registration for the 2021 AAZK National Conference.

Facing challenges in a regular part of the job for an animal care professional. Whether building a relationship with an animal, working through disagreements with coworkers, or troubleshooting the myriad of problems that arise from working with wild animals, setting and overcoming difficult trials can be a rewarding aspect of the profession. But what about the challenges that are faced by our local Chapters? While they may not be as readily apparent as some other cases, AAZK Chapters are often faced with opportunities to triumph over challenges.

Finding better ways to support deserving conservation organizations is always at the forefront of Chapter goals, but given the challenges faced in the last year, it is even more important for many Chapters in 2021. The BFR and TFYM teams are always hard at work finding ways to support those working to support these programs, but many AAZK Committees have created excellent resources on improved fundraising efforts. Please check out the members' page of the AAZK website for member and AAZK C.O.R.E. for these resources and don't hesitate to reach out to Committees and Programs via e-mail for more support.

New member recruitment is a common challenge for AAZK Chapters. Informing coworkers of the benefits of joining AAZK and getting them interested in participating in these challenges can be daunting. The AAZK Resource Committee has recently put together a short video and presentation that can be used to gain new members at the Professional, Affiliate, and Student levels. And what better time to use these new resources than right now. AAZK is rolling out a contest rewarding the most successful recruiting Chapter and new or renewing individual members with free registration for the 2021 AAZK National Conference. So be sure to check your AKF, inboxes, and social media for details on the contest.

And speaking of the 2021 AAZK National Conference, the Chapter Challenge is underway to support the Los Angeles Chapter of AAZK in their efforts to put on a successful virtual Conference this year. With increased audio/visual costs due to the virtual format of this year's conference, Los Angeles AAZK needs your Chapter's help in this last fundraising push to make the 2021 AAZK National Conference a big success. There are multiple options for your Chapter to show their support so visit AAZK2021.org to take the challenge and support the cause.

Cheers,

Paul B

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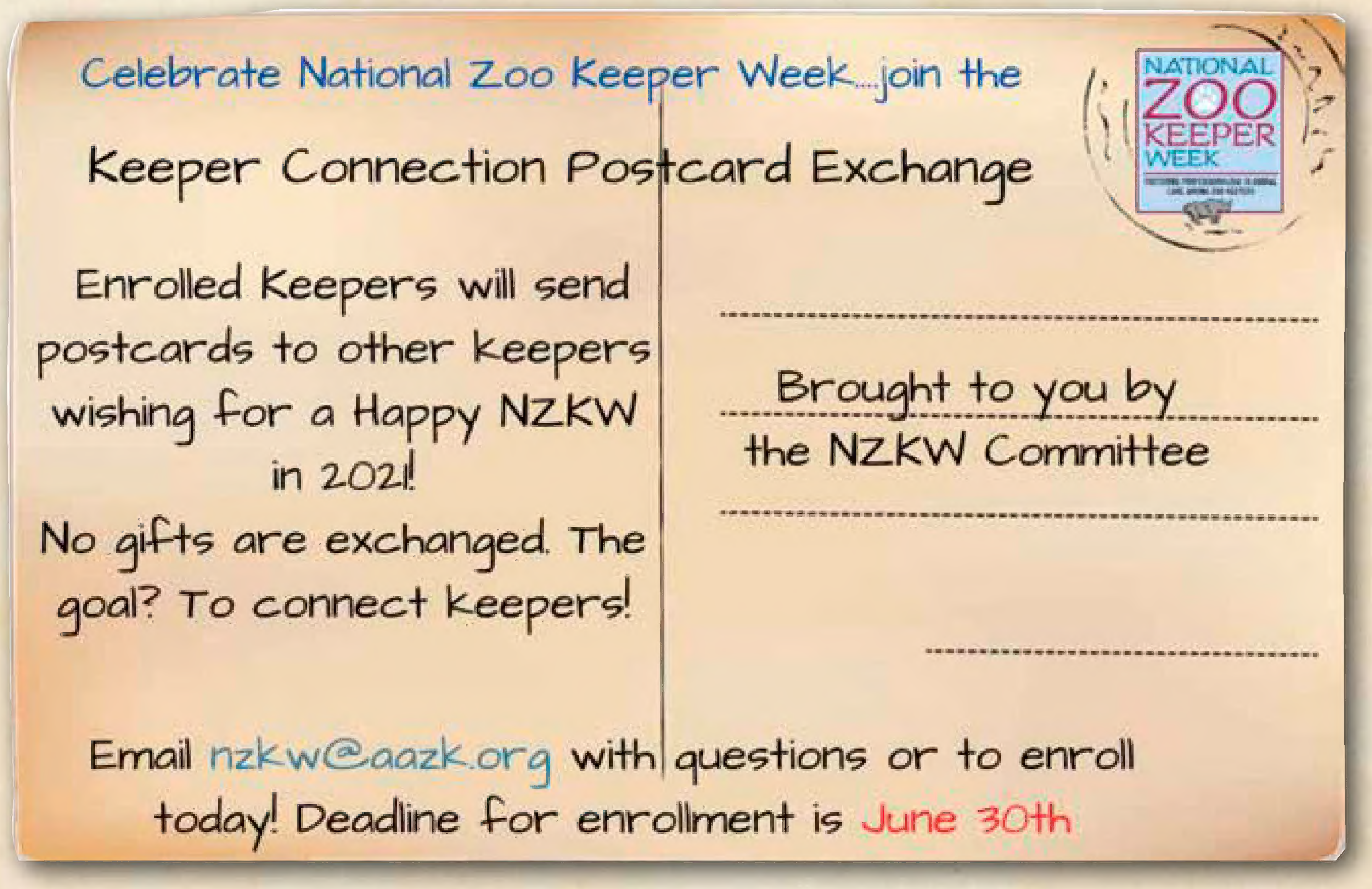

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Hungry for Answers: Examining desert bighorn sheep *(Ovis canadensis nelsoni)* diet access in human care

Amanda Lussier
Senior Mammal Keeper
San Diego Zoo Safari Park
Escondido, CA

A watchful ewe

ABSTRACT

This study compares the frequency of which the desert bighorn sheep (*Ovis canadensis nelsoni*) herd at the San Diego Zoo Safari Park (SDZSP) in Escondido, CA access their pelleted feed in their barn in the morning versus the evening feedings. This paper examines whether or not bighorn sheep show any preference for accessing pellet based on feeding time. At SDZSP, the bighorn should be getting 60% of their daily caloric needs from the pellet, with the remaining 40% coming from Bermuda hay. Little is known about their evening feeding patterns since keepers have gone home at that time. Data collected shows that on average, the bighorn entered their barn for the pellet in the evening at higher rates than in the morning. Individual animals showed preferences for the time of day the pellet was accessed. Several studies performed by others on ewe dominance (Favre et al., 2008) as it relates to resources, wild bighorn foraging patterns (Gedir et al., 2016), and zoo nutrition (Crissey, 2005) all contribute to the greater understanding of this topic. This research will better inform zookeepers about pellet accessibility challenges for the bighorn herd as well as individual animals.

INTRODUCTION

The desert bighorn sheep (*Ovis canadensis nelsoni*) is a resilient ungulate species native to the Southwestern United States and northwestern Mexico. Although their status is listed as least concern, the Lower California or Peninsular Range bighorn are endangered with an estimated population of 1,000 individuals (Abella et al., 2011). Many of the threats facing bighorn sheep populations are human-caused. Habitat fragmentation, human encroachment, and disease transmission from domestic animals have contributed to their decline in numbers (Epps et al., 2018). Despite their small population, land management and conservation efforts have helped the bighorn rebound in these areas from as few as ~276 animals in the late 1990s. (Rubin et al., 1998). Investigating how these animals use their environment and resources, as well as studying the connectivity of their groups throughout the southwestern region is important in continuing their survival (Epps et al., 2018).

A wild ram forages at the valley floor

Bighorn sheep, like many ungulates, are social animals. The size and composition of their herds in the wild vary, although mature bighorn are commonly found in single sexed groups (Castelló et al., 2016). Typical group size is around 6-10 individuals but in a few cases, very large herds approaching 100 animals have been spotted (Castelló et al., 2016). Within these herds, there is typically a dominance hierarchy. Dominance can influence resource acquisition, particularly in ranges that experience extreme seasonal changes in food availability (Favre et al., 2008). Ungulates living in very cold regions have been shown to benefit from their social rank when it comes to foraging underneath snow (Barrette and Vandal, 1986). Barrette et al. (1986) focused on female reindeer (*Rangifer tarandus*) to study this idea. Researchers found a strong association between age and mass as it related to the reindeer's ability to maintain their body condition during the winter. Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) face similar challenges to those of the reindeer during the winter season. More research is needed, however, Favre et al. (2008) support the idea that in an environment with limited resources, dominant bighorn females may have an advantage.

As their name suggests, desert bighorn sheep reside in very arid environments. Living in regions with extreme temperatures and limited water availability can present challenges. Due to the desert's harsh summer conditions, bighorn sheep have developed methods of foraging to maximize water retention and nutrient balance (Gedir et al., 2016). Seasonal changes in water sources and food availability can influence their diet selection (Gedir et al., 2016). Like many other mammals who occupy arid regions, desert bighorn sheep are able to meet some of their water needs by eating plants that retain moisture, such as succulents (Israel et al., 2016).

Although there have been many studies conducted on resource availability and food preferences of desert bighorn sheep in the wild, there is not much information published on their diet access and foraging behavior in a zoo setting. The diet and nutrition of zoo animals directly contribute to their overall health (Crissey, 2005). Mammal keepers at the San Diego Zoo Safari Park in Escondido CA work alongside veterinary staff and nutritionists to develop and implement diet plans specific to animal needs. Although the diet of wild desert bighorn sheep has been studied extensively, there is a lack of information available on captive bighorn feeding patterns.

The SDZSP bighorn sheep receive 60% of their daily caloric requirements from pelleted feed and the remaining 40% from Bermuda hay. Their pellet is specially formulated by nutritionists to ensure the bighorn receive a diet that is closely matched to their nutritional needs in the wild. Zookeepers monitor the bighorn's daily consumption rates by measuring pellet and hay every morning and noting how much food is leftover the next day. Many hoofstock keepers can appreciate the struggles that accompany managing herds of animals, particularly when it comes to feeding time. In enclosures that have limited space and species with dominance hierarchies, it can be challenging to ensure that each individual is able to access their complete diet.

Because captive animals depend upon their keepers for their dietary needs, it is important that zoo staff are able to ensure those needs are being met. Due to the pellet being a recommended part of the animals' diet, it is imperative that keepers know if all members of the herd are accessing their pellet during feeding times. The current feeding assessment of these bighorn is as a group unless an individual animal exhibits a thin condition or overall poor appearance. Body condition scoring may be performed by a veterinarian or nutritionist at the request of a keeper, at which point supplemental feeding may be prescribed to put weight on the individual.

A healthy population of bighorn sheep in human care is beneficial to better understand the behavior of these animals, as well as provide a safeguard to population numbers in the wild. By knowing if there are challenges to accessibility, we can look for ways to better provide for all animals within a herd. In order to identify these challenges, keepers first need to examine the daily diet consumption of their herd as well as individual animals. This study set out to examine the frequency of which the SDZSP bighorn sheep herd access their pellet, which is fed inside of their barn.

STUDY SITE AND SUBJECTS

This study was conducted at the bighorn sheep barn located at the SDZSP. The barn is connected to the bighorn sheep exhibit by an alleyway with a sliding door entry operated by a pulley from outside of the enclosure. The alley is measured to be 1.8m (6ft) wide and 39m (128ft) long. The bighorn barn has a large open room that is measured to be 7.3m x 3m (24 ft.x 10 ft), and has two smaller rooms attached at opposite ends, both measured to be 3.7m x 3.4m (12 ft.x 11 ft).

The bighorn sheep herd at the SDZSP is composed of seven females. The ages of these animals range from 1-16 years-old. There is one yearling, three juveniles under five years of age, and three older ewes. Each animal has ear notches specific to that individual, which keepers use to distinguish between animals.

FEEDING PROTOCOL

The bighorn herd receives 7.7 liters (7 quarts) of pellet in the morning in their barn when keepers arrive to clean the exhibit, and again in the evening when keepers give them overnight access to their barn. That equals between 1.1-2.2 liters (1-2 quarts) per animal each day. Since the herd is fed as a group, the pellet is poured out in several feeding stations throughout the barn to ensure that animals are able to access food without crowding. The bighorn herd also has access to a total of 2.5 flakes of Bermuda hay for grazing throughout the day, both in the exhibit and in the barn. Animals have access to water, as well as mineral and salt licks all day, both inside of the barn and out on exhibit.

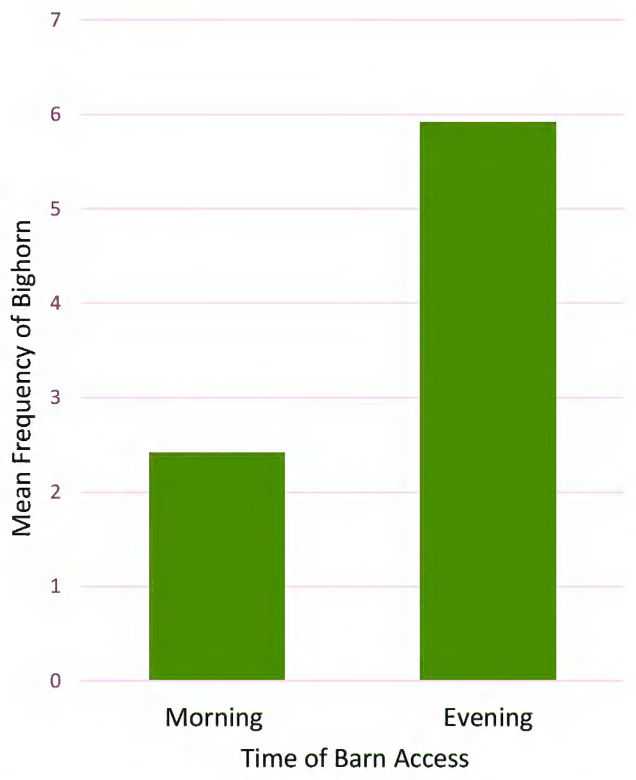

Figure 1. Mean frequency of bighorn entering barn during morning vs. evening pellet feedings.

During the morning feeding, keepers are present and animals which enter the barn for pellet are closed inside so that keepers are able to clean their exhibit with a water hose and leaf blower. After cleaning, the bighorn are released on

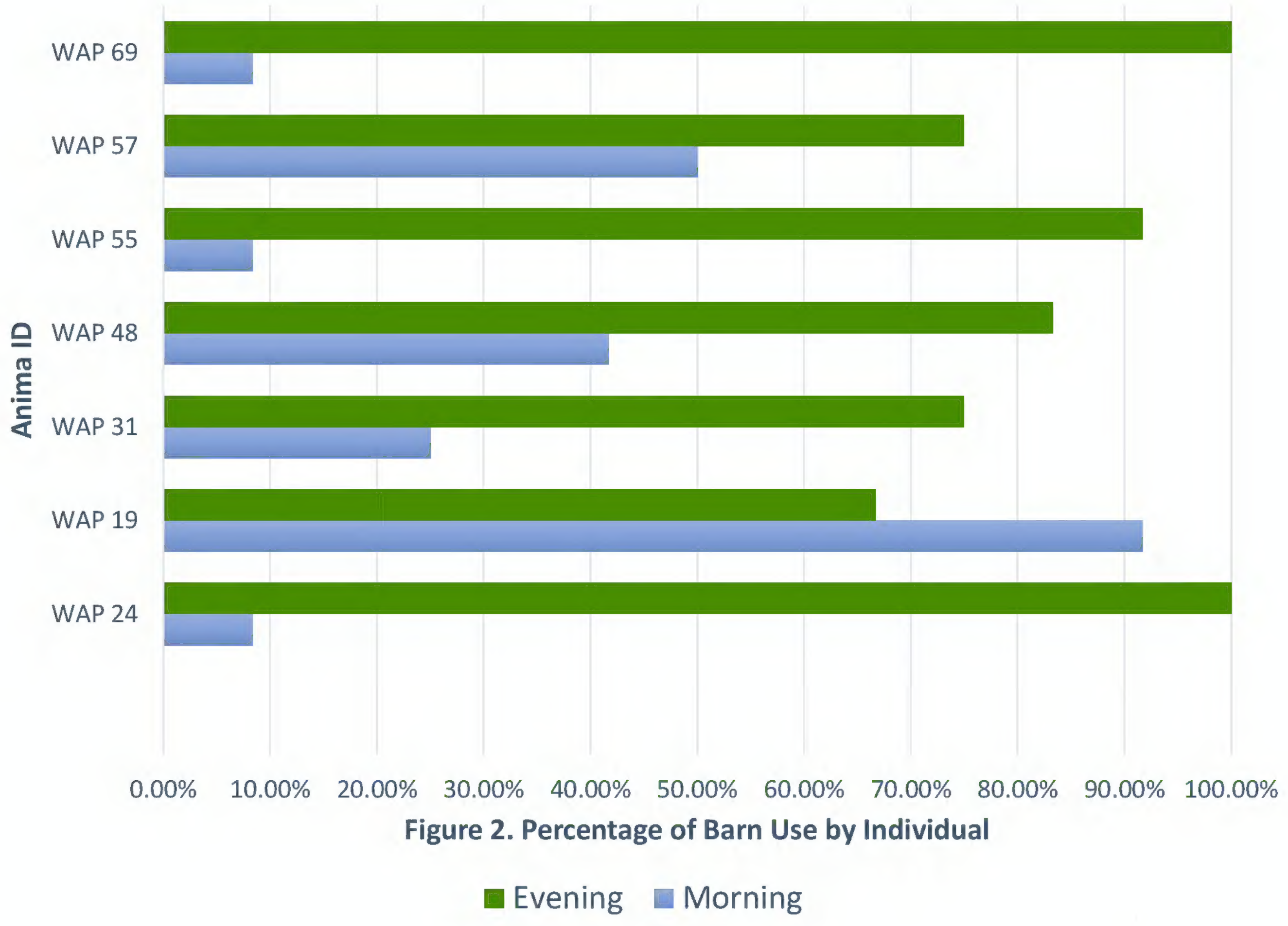

Figure 2. Percentage of Barn Use by Individual

Alley location camera provides close up photos of bighorn for individual identification

exhibit and no longer have access to pellet inside the barn. In the evening keepers open the barn and depart for the day, which leaves the animals with free access overnight without being closed in.

DATA COLLECTION

Data were collected twice a day (morning and evening) from 5 July- 16 July 2018. For the morning feeding, bighorn were offered 7.7 liters (7 quarts) of pellet inside their barn and given 25 minutes to decide whether or not to enter. The sliding door was then closed, with animals inside the barn, and the number of animals which accessed the food, along with their notched ID, were recorded. After keepers were done cleaning the bighorn exhibit, which typically takes an hour, animals were released from their barn and restricted from that area until their evening feeding.

For the evening feeding an additional 7.7 liters (7 quarts) of the pellet was offered inside the barn. Animals were given free access to the alleyway and barn with the door remaining open overnight. Two camera traps were set up- one in the alleyway and another in the barn- to record the time of access and ID of the animal. The alley camera was set up to capture close-up images of the bighorn as they entered the barn for identification purposes, and the second camera angle allowed for a view of the large barn room to see how many animals occupied the area at a time (Images 1 and 2). Keepers reviewed camera footage each morning, recording the number of animals who entered the barn along with the timestamp. There was no time limit imposed on the evening feeding since the goal was to determine which animals accessed their food in the morning versus evening with the existing routine.

CRUNCHING THE NUMBERS

The program SPSS was used to run statistical analysis. The data proved to be normally distributed, which meant a parametric test could be performed. A paired t-test in Excel compared bighorn frequency between morning and evening pellet feedings.

For the morning pellet feeding, the average number of bighorn accessing the barn was two individuals (SD=1.6). For the evening pellet feeding the average was six individuals (SD=0.9) (Fig.1). The morning feeding had a max=6, min=1, and a range=5. The evening feeding had a max=7, min=4, and a range=3.

A paired t-test found that bighorn sheep entered their barn at a significantly lower rate in the morning to access pellet (2± 1.6) than in the evening (6± 0.996), t (11) =6.28, p=0.000. These data support the alternative hypothesis that bighorn enter their barn at different rates in the morning versus the evening to access pellet feed. Further breakdown of the data showed that individual bighorn sheep exhibited a preference for feeding time.

CHEWING IT OVER

This research project examined if bighorn sheep entered their barn at different rates during the morning versus the evening to access their pelleted food. The hypothesis was that bighorn would access the barn at different rates during those two feeding times. The data collected from this study is very useful in informing the daily care of these animals. One concern was that bighorn individuals who weren't accessing pellet during the morning feeding when keepers were present may also not be getting access to their pellet during the evening. Reviews of camera footage and data analysis showed that all animals were able to access the pelleted food at least once a day, whether it be morning, evening, or both. The data showed that not only was there a significant difference in the frequency of bighorn who entered the barn during the morning versus the evening feeding times, but there were also feeding time preferences for specific individuals.

When looking at the data from an individual animal standpoint, some interesting patterns emerged. For example, bighorn individuals WAP 24 and WAP 69 both accessed the barn only once during the 12 day observation period for their morning pellet but accessed the barn every single evening to eat the pellet. This might be explained by the herd dynamics and social structure of these animals. WAP 24 is the mother of WAP 69. Sheep lambs, both wild and domestic will exhibit a following response once they imprint on their dam (Forrester and Hoffmann, 1963). It's possible that WAP 69 is still very attached to her mother even though she has been weaned for over a year now. WAP 69 is also the youngest ewe in the herd and likely the least dominant female due to her age and mass (Favre et al., 2008). WAP 24 is the oldest female but is no longer the most dominant ewe. WAP 24 is 16-years-old and during keeper observations will avoid confrontation with the alpha female WAP 19. In wild bighorn herds, access to resources may be influenced by ewe dominance (Favre et al., 2008). Research has shown that in this species, dominance within a herd is tied to age and mass. Larger, older ewes appear dominant over younger females. As females age past seven years and their mass decreases they are challenged by up and coming ewes (Favre et al., 2008). To improve this study in the future, it would be helpful to examine the relationships and hierarchy within this herd.

In continuing this research, another area of future study could be the use of the barn as a feeding area. Since bighorn in the wild live in areas with some cover but high visibility (Miller and Gaud, 1989), the SDZSP bighorn may be less inclined to eat inside of an enclosed barn, particularly in the morning when they are shut inside. It would stand to reason that they would be more likely to access their pellet resource in the barn during the evening feeding when they are able to move in and out of the barn at will. If the morning feeding of the bighorn could be manipulated to allow barn access without closing them inside, then keepers could determine if animals are reluctant to enter the barn when they anticipate the door will be closed behind them.

Seasonal temperatures and feeding times could also impact the results of this research. To have a better idea of the SDZSP bighorn foraging patterns, a multi-season observation period would be beneficial. Wild bighorn sheep often vary their daily activity during times of extreme heat (Gedir et al., 2016). During the data collection for this study, there was a heatwave with peak temperatures reaching 116 degrees Fahrenheit. This might explain why on some days bighorn were observed in their barn between the hours of 2000- 0000 hours.

Lastly, further study on diet item preferences of the SDZSP bighorn herd would be helpful in understanding how motivated these animals are to eat their pellet when other food items like Bermuda hay are easily accessible. Research on zoo diet item selection has been done with other animal species that indicates if there is a surplus of preferred food items available, animals will consume those items first and may not consume the less desired food (Crissey, 2005).

CONCLUSION

The research performed in this study was a good starting point for understanding the overall pellet consumption patterns for this specific herd of desert bighorn sheep. The results acquired are useful to help mammal keepers and zoo nutritionists know where there could be improvements in animal diet accessibility. With so many variables that could be affecting the individual animal's decision on whether or not to access the barn area for the pelleted food, there is a need for much more research to be done. There is great value in understanding diet consumption as it relates to animal well-being in a zoo setting, whether it be for nutritional needs, activity and engagement patterns, or recognizing changes in appetite tied to changes in health. Having a good foundation of knowledge on zoo animal habits helps contribute to being able to provide the best possible care to animals in captive settings.

Image 2. Barn location camera provides view of the number of bighorn accessing pellet at a given time

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The Effects of a Variable Diet on Cougar *(Puma concolor)* Behavior at Great Bend Brit Spaugh Zoo

Sara Hamlin, former Zoo Supervisor/ Curator
Great Bend Brit Spaugh Zoo
Great Bend, KS, USA

Tanner

INTRODUCTION

In my twelve years of experience as an animal care professional, I would say the most common visitor complaint that I have heard is that the visitor perceives an animal to be unhappy because it is pacing. Big cats in managed care have a bad reputation to exhibit stereotypic behaviors, like pacing (Swaisgood and Shepherdson, 2005). In fact, Swaisgood and Shepherdson (2005) found that captive managed felids spend 20 percent of their time on average exhibiting stereotypic behaviors, like pacing. Stereotypic behaviors are repetitive behavior patterns that have no clear goal (Mason, 1991) and can be caused by the inopportunity to exhibit species specific natural behaviors (Swaisgood et al., 2003). While wild cougars spend the majority of their time resting or patrolling their territory (Antonio et al., 2017), in a managed care setting, felids are provided with a nutritionally balanced diet, often in only a few meal portions, and a limited territory creating an excess of time for the animal to use in its day. By being fed processed foods, captive felids are not able to use natural foraging strategies that would require the use of many muscle groups and satisfy the instinctual drive to hunt (Lindburg, 1988).

The cougar, *Puma concolor*, has dozens of common names based on the part of the wide-ranging territory it occurs (The Cougar Fund, 2019). The cougar is a medium-sized cat, weighing on average 30-100 kilograms, and are apt climbers capable of jumping large distances horizontally and vertically (Antonio et al., 2017). In the wild, their diet varies from large prey like elk, deer and bighorn sheep to smaller prey like rabbits and raccoons (The Cougar Fund, 2019). Wild cougars will do most of their hunting at dawn and dusk (Antonio et al., 2017), spending much of their time resting or patrolling their territory (Antonio et al., 2017). On the other hand, in a managed care setting, cougars are provided with a nutritionally-balanced diet, often in only a few meal portions, and a limited territory creating an excess of time for the animal to use in its day. By being fed processed foods, managed felids are not able to use natural foraging strategies that would require the use of many muscle groups and satisfy the instinctual drive to hunt (Lindburg, 1988).

Behavioral studies are an important tool in the management of captive species. Keepers make informal animal behavior assessments on a daily basis, but these are often very subjective and can vary from observer to observer (Troxel-Smith et al., 2017). The need for a standardized assessment is crucial to properly analyze the behavior of an individual. An ethogram offers a clearly defined list of behaviors, and it is vital to precisely define those behaviors (McDonnell and Haviland, 1995).

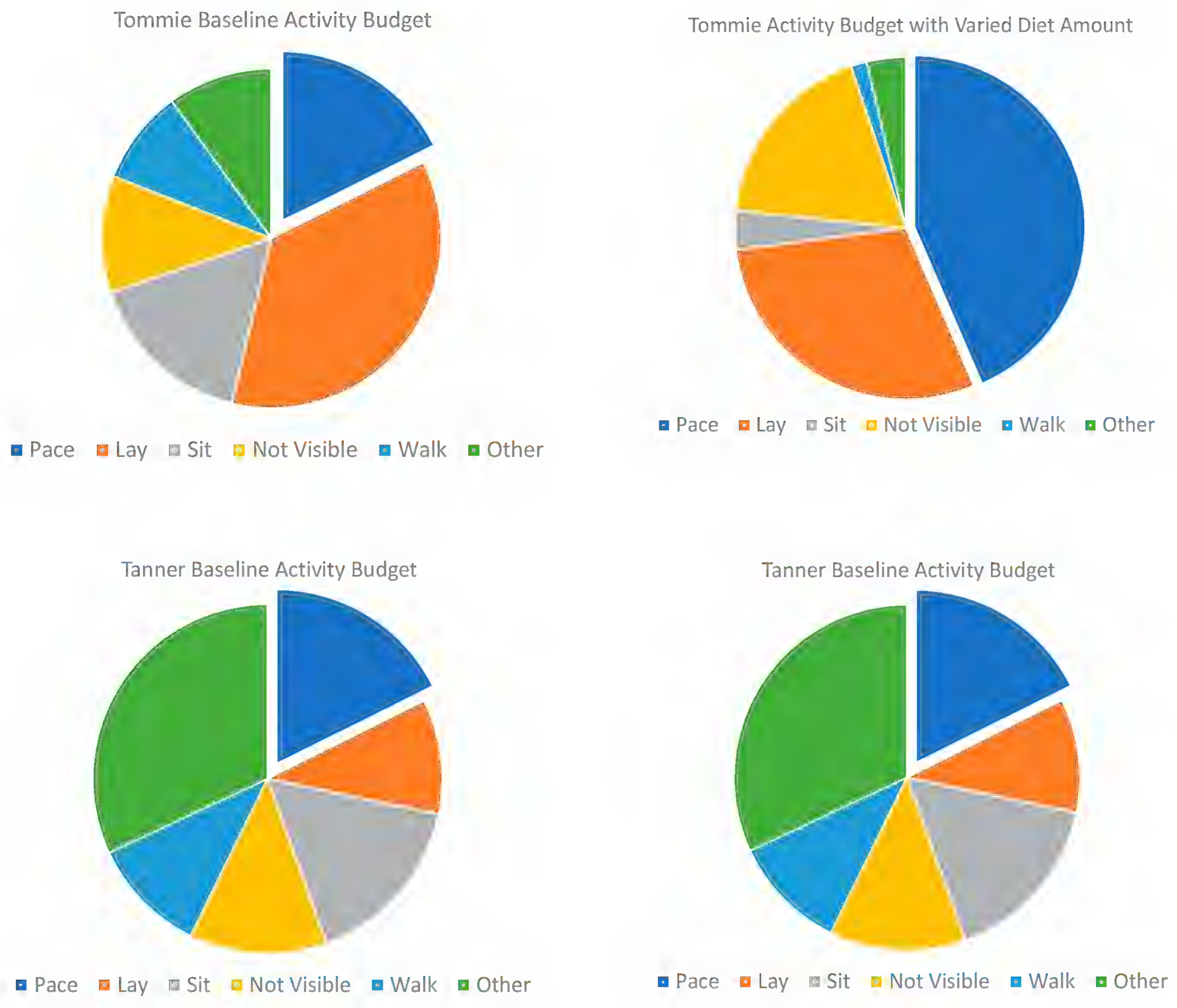
Many animal care staff use out-of-the-box thinking in order to create the best welfare possible for the animals in their care. Numerous studies have examined the connection between

Table 1: Diets offered to each cougar before the experimental change

Tommie	
AM: 1 Medium Red Tupperware	PM: 1 Metal Bowl
1 1/2 lbs Nebraska Feline Diet	2 lbs Nebraska Feline Diet
	Wednesday: diet + knuckle bone
Tanner	
AM: 1 Medium Red Tupperware	PM: 1 Metal Bowl
1 lb Nebraska Feline Diet	2 lbs Nebraska Feline Diet
	Wednesday: diet + knuckle bone

Table 2: Diets offered to each cougar after the experimental change

<table>
<tr><th colspan="4">Tommie</th><th colspan="3">Tanner</th></tr>
<tr><td colspan="4">AM: 1 Medium Red Tupperware</td><td colspan="3">AM: 1 Medium Red Tupperware</td></tr>
<tr><td colspan="4">1 1/2 lbs Nebraska Feline Diet</td><td colspan="3">1 lb Nebraska Feline Diet</td></tr>
<tr><th colspan="7">PM: 2 metal bowls, each</th></tr>
<tr><td>SUN</td><td>MON</td><td>TUE</td><td>WED</td><td>THU</td><td>FRI</td><td>SAT</td></tr>
<tr><td>3 lbs
NE Feline</td><td>1 lb
NE Feline</td><td>4 lbs
NE Feline</td><td>Bone</td><td>3 lbs
NE Feline</td><td>2 lbs
Feline</td><td>XL
Chicken</td></tr>
</table>


Tommie Baseline Activity Budget

Tommie Activity Budget with Varied Diet Amount

Tanner Baseline Activity Budget

Tanner Baseline Activity Budget

Figure 3: Activity budget for each cougar before and after treatment

Tommie and Tanner

environmental enrichment and reduced stereotypic behaviors (Swaisgood et al., 2003; Skibiel et al., 2007; Carlstead and Shepherdson,1994; Shepherdson, 1998) but few have studied how diet presentation can affect the amount of time an animal exhibits stereotypic behaviors. This led to the question: Does altering the daily amount of food offered to the cougars at Great Bend Brit Spaugh Zoo cause them to exhibit the stereotypic behavior of pacing more or less often? I hypothesized that there will be a decrease in stereotypic pacing when there is variability in their diet due to more variation in their routine and less predictability.

METHODS

Two male cougars that live at the Great Bend Brit Spaugh Zoo were the study subjects. They are five and six-years-old and were both orphaned in the wild before they were placed at the Great Bend Brit Spaugh Zoo under a year of age. 'Tanner' was blind when he was found orphaned, which is the only health related issue that either cougar suffers. 'Tommie' is castrated, and Tanner is intact. The habitat they share is 4.9 meters wide by 9.8 meters long with large boulders in place for climbing and hiding and they always have access to their building unless keepers are cleaning. They are separated into two indoor stalls while being fed so that their consumption can be monitored. They are offered environmental enrichment three times a week at minimum.

The zoo has a standardized sheet of behaviors with descriptions that was used for the ethogram along with a standardized spreadsheet to record the data. Data were recorded every minute in half hour increments for each cougar separately. Data were collected to cover each of the half hour increments from 0800hours to 1700hours. This timeframe was chosen because these are the hours when humans are present in the area surrounding the cougars and staff are available to observe cougars. The observers, keepers and interns, were trained on what each of the described behaviors means in order to minimize observer bias. The observers were instructed to enter the public viewing area at least ten minutes prior to the ethogram so that any excitement caused by their presence had subsided so as not to skew the cougar's behaviors. Observers sat on a bench located just behind the public walking path in front of the cougar exhibit. Communication radios were turned off and no talking by the observer was allowed so that it would not interfere with the cougars' regular activity.

Baseline behavioral data were collected from January to July 2019 while the cougars were being fed a standardized amount of about 0.90 kilograms of Nebraska Feline Diet at 1600hours every day except for only a bone on Wednesdays. A keeper submitted a diet change request to adjust the cougars diet amount to attempt to mimic the daily variation a cougar would experience in the wild. After the veterinarian approved the keeper's requested diet change, the cougars' diet was changed to the scheme found in tables 1 and 2. The morning diet portion remained the same through both treatments as that is when medications are administered and therefore need to stay consistent and allowed for individualization for each cat. A data set was collected from September to November 2019. The time of feeding was kept the same for both treatments to stay consistent, and to follow the function of shifting purposes in a zoo setting.

RESULTS

Results were organized into six main categories based on the five most dominant behaviors and a category of 'other' behaviors that encompasses all other behaviors seen, including running, playing, grooming etc. Coincidentally, each cougar spent the exact same amount of time pacing during the baseline, 90 minutes each, though at different times of the day. Even more oddly, each cougar spent nearly the same amount of time pacing in the second treatment with varied food amounts, 235 minutes for Tommie (figure 1C) and 234 minutes for Tanner (figure1D). As a result of the treatment, it appears that Tommie now spends less time laying down, 29% of the time (figure 1C) compared to 36% (figure 1A), while Tanner spends more time laying down, 28% of the time (figure 1D) compared to 11% of his time (figure 1B).

Results were analyzed using an Anderson-Darling Normality test and a paired t-test used to identify for directionality. A repeated measurement design was used because each participant took part in each treatment. Due to one missing set of data points from the first treatment, the percentage of time spent pacing from the baseline was compared to the percentage of time spent pacing during the varied amount treatment. There were no differences in cougar activity between a constant or a varied diet (t-test, P =0.006, α-=0.05).

DISCUSSION

While I did see a change in the amount of pacing done by each cougar, it was not a statistically significant amount. I also expected to see a decrease in pacing, when, the cougars paced more after the diet change. With the change in diet variability I predicted that there would be less pacing, but each cougar exhibited a significant increase in the amount of time spent pacing.

There are some confounding factors that may have influenced the results like observer biases. While each observer was trained on what each behavior means, and how to perform the ethogram, there are still some potential differences in the way each observer makes observations. Allen et al. (2014) found that wild cougars do exhibit seasonal diet variation, mostly based on prey availability, but there is the possibility that there may be some instinctual drivers that can affect even managed cougars. If I were to do this study again, I would have observations done at the same time each year to rule out any seasonal factors. The study would also be more robust if there had been more time overall to collect data, including overnight behaviors.

Even though the results were not what I hypothesized, I do believe that there is significant knowledge to be gained here and still to some degree consider this a confirmation of my hypothesis that diet variability does affect the amount of time the cougars at Great Bend Brit Spaugh Zoo spend pacing. An explanation for the increase in pacing may be explained in a similar way to a study done recently on managed lions. Höttges et al. (2019) found that lions exhibited more pacing and antagonistic behaviors on days that they were fasted compared to feeding days. They also found that lions at two different zoos but under the same experimental feeding regime treatment exhibited very different amounts of time spent pacing, leading the researchers to conclude that there are other factors that also drive an animal's compulsion to pace (Höttges et al., 2019). Antoni et al. (2017) found that many cougars exhibit different cycles of activity from each other to the point that some are diurnal and some are nocturnal which leads me to believe that each individual may need its own feeding strategy rather than a feeding strategy that is applied to all members of the same species.

For future research, I would continue to explore how diet changes can affect an animal's behavior. I would like to investigate how the time of day feeding takes place or the location of where the diet is placed might affect the amount of time the cougars spend pacing. As well as further study, if the increase in pacing seen in this study coincides with the fasting/low feed days like what was found by Höttges et al. (2019).

This study is important in terms of how we care for animals in a managed setting. As wild spaces continue to shrink in order to make room for human activities, zoos and managed breeding programs are becoming more and more necessary to keep endangered species from dying out. At this time, cougars are not part of a captive breeding program, but many cat species exhibit many of the same behaviors and tendencies, and research done on them can be translated to other captive felids.

CONCLUSIONS

The broad goal of this study was to determine if diet has an influence on the behavior of the animals in the study. While offering a varied amount of diet to the cougars at Great Bend Brit Spaugh Zoo did not have the effect I had predicted, it did demonstrate a strong connection between behavior and diet. There is a wealth of research that has been done on how environmental enrichment has positive impacts on animal welfare and what components of diet are nutritionally complete for a species but little research has been done

Cougar habitat

to examine certain aspects of care that tend to be standardized, like the amount of diet offered each day. Many decisions are made daily that impact the care given to the animals in our charge and it is important that these changes be studied so that we can ensure that we are not creating unintentional consequences.

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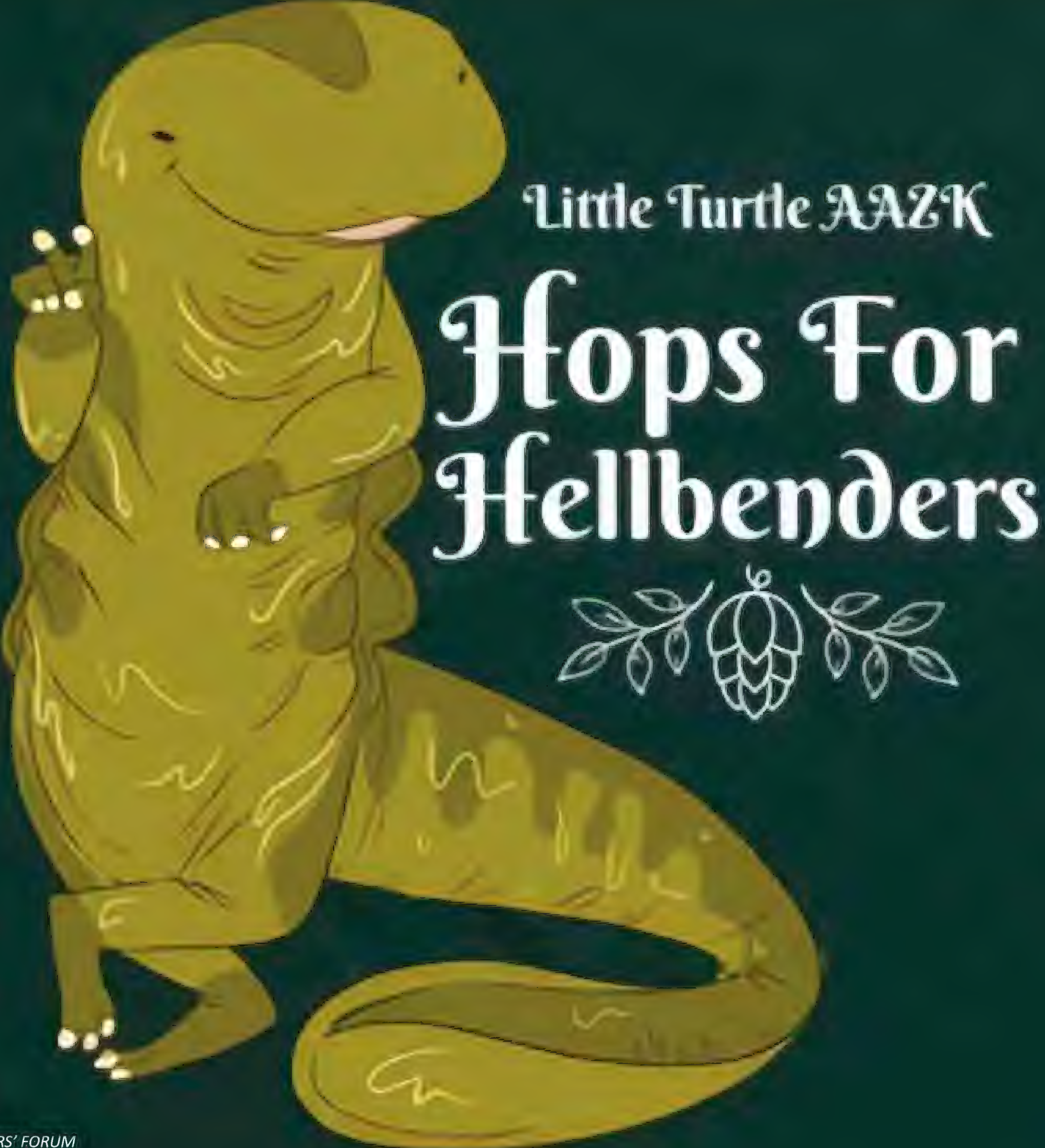
The Hops for Hellbenders Model: How to plan a fundraising event to raise money and awareness

Rachel Wheeler, Central Keeper
Fort Wayne Children's Zoo
Fort Wayne, Indiana



INTRODUCTION

One of the American Association of Zoo Keepers' (AAZK) purposes is "contributing to local and global conservation through fundraising" (AAZK, n.d.). Non-government organizations play a critical role in conservation. Many of these organizations rely solely on public donations to fund their research and activities. As a result, fundraisers can have major effects on conservation outcomes (Verissimo et al., 2018).

In the fall of 2019, the Little Turtle AAZK Chapter in Fort Wayne, Indiana hosted their first Hops for Hellbenders, a drink-to-donate event at a local brewery. The event raised over $1,100 for Hellbender (*Cryptobranchus alleganiensis*) conservation and cost the Chapter zero dollars out of pocket. It was a long road that had various twists and turns, but eventually led me to leading and organizing a successful fundraiser. The event exceeded my goals and expectations, brought me closer to my community, and supported an important cause. It was such a fun and rewarding experience from start to finish, but my road could have been a lot smoother if I would have had a map or model to follow. In sharing my experience with others, I hope that it may encourage them to get more involved in the planning process of their Chapter's events or inspire someone to step out of their comfort zone and lead their own fundraiser.

(Pictured left) This logo was used on t-shirts for the event.

HOW TO GET STARTED

Once you have an idea, getting started can be the hardest step in the process. It's important to remember that you're not alone. First, I approached my Chapter's executive board to let them know I was interested in creating and planning a new event. I was surprised to find how supportive they were. They suggested that I use a drink-to-donate style fundraiser, which is a social event where a group will go to an establishment on a set date and the establishment donates back a set percentage of sales to the group's cause. These events are also known as dine-to-donate, restaurant give-back nights, or profit shares (Group Raise, n.d.).

When setting goals for an event, you can set a goal for attendance, money raised, or both. Setting fundraising goals helps to ensure that you and your Chapter are on the same page. Keeping track of where you are in terms of meeting goals can also give you important information that can be used to adjust your strategies or improve your outreach (Stein, 2012). Another important goal of conservation fundraising is raising awareness for your cause. You may not be able to track how many people you interact with or how someone's habits may change as a result of them learning something new at the event. However, that unseen impact can create a ripple effect that lasts long after your event ends. While this goal might be harder to measure, it's still something that should be thought about early on, so you have the help and resources to achieve it.

HOW TO PICK A THEME

While I knew the type of event I wanted to plan, I still needed to pick a theme or an animal to be the face of the event. Other AAZK fundraisers seem to always focus on "charismatic" species. A charismatic species is typically defined as a well-known large mammal species that is valued symbolically, economically, and socially with widespread appeal from the public (Albert et al., 2018). These species can stand as rallying points for environmental activists to initiate further conservation awareness and action. The draw of these species also helps to pull in financial support from institutions and the public (Ducarme et al., 2012).

You need to pick a theme that you're passionate about in order to make planning an event more personal and rewarding for you. In my case, I wanted to go a different route. I wanted to highlight a lesser known species that the public may not normally know of or care about. We chose an animal and a nonprofit that our zoo was already involved with, Help the Hellbender. This organization partners with zoos in Indiana and across the region to raise hellbenders to be released back into the wild, while raising public awareness about this species (Help the Hellbender, 2018). The hellbender, also known as a devil dog,

Image 1.Hellbender mascot costume

snot otter, or lasagna lizard, is a large, aquatic amphibian with a flat head and wrinkled body (Terrell, n.d.). While they may not be cute and fuzzy, hellbenders are extremely important to their environment, but are they charismatic? Many would probably say no, but other unfavored species have been artificially constructed as charismatic through thoughtful marketing and educational programs (Ducarme et al., 2012; Lorimer, 2006).

Naming the event was my next step. Coming up with the event name was a fun experience, but I did have to do a little research. You should focus on what your event is about by picking words unique to the type of event you're planning. Whatever name you choose, it should convey your theme and get the attention of your audience (Matthes, 2015). Alliteration is another tool used by many companies and brands, including the nonprofit Help the Hellbender, and can be used to grab the audience's attention and create memorability (Wolfson, 2017).

HOW TO PICK A VENUE

Picking a venue can be challenging depending on your location. The best restaurant fundraisers are conveniently located in your community, so that as many people as possible can attend (Group Raise, n.d.). This means that parking and venue capacity should be taken into consideration, as well as if the venue is family friendly or not.

When reaching out to a potential venue, you can contact the venue directly or go through their website. Some chain establishments already have a detailed fundraiser program in place where you can fill out a short form or application to be processed at a corporate level. They may require a tax ID number which your Chapter's executive board should be able to provide (Hamilton, 2019). For non-chain or family-owned establishments you may just have to reach out to them through their contact section.

Another challenge to choosing a venue is the cost of using the space. When you're on a budget, the idea of spending money to host a small private fundraiser might mean losing most of your profit. If you do want to host a private event, allowing tickets to be purchased in advance can allow an accurate estimate of the number of attendees expected. For Hops for Hellbenders, I was very up front when contacting venues and asked if they would be willing to donate space to allow us to host a public event that would be free to attend. It's important to let the venue know how this can benefit them through publicity and reaching new customers. Some venues are bound to say no, but you'll most likely be able to find a venue willing to work with you. Once a venue agrees to work with you, start building a rapport with a manager or other employee so you have a point person throughout the rest of the process.

Picking a date will need to be a mutual agreement between your Chapter and whatever venue you work with. Before reaching out to venues, look at your Chapter's upcoming calendar and select a few potential dates. Some venues will allow groups to hold an event anytime, including weekends. Others may prefer a weekday event when business might be slower and event attendance won't compete with usual patron traffic.

HOW TO FIND AND UTILIZE VOLUNTEERS

After you have your main logistics for the event figured out, you'll probably have a better understanding of how much help you're going to need to organize and run the event. From acquiring donations to social media, there's a lot more that volunteers can help you with than just support at the event (20 Bedford Way, 2017). Volunteers can be members of your Chapter, other zoo staff, zoo volunteers, or members from your community. For Hops for Hellbenders, I was approached by two local students who needed volunteer hours to receive course credit.

Make sure volunteers know what is expected of them. Assign them structured tasks with a timeline but allow them some freedom and flexibility with accomplishing them. Be sure to check in with your volunteers, either through face to face meetings or electronically. Make sure they know who they can go to if they need help or have questions with a task (20 Bedford Way, 2017). I assigned my volunteers the task of reaching out to local businesses for donations prior to the event and coming up with an activity to do during the event. For acquiring donations, I provided the volunteers a letter to give to businesses that had the event information, a request for donations, and my contact information.

HOW TO RAISE AWARENESS FOR YOUR CAUSE

Changing behavior or perceptions around a cause begins with awareness but raising awareness can mean different things depending on your cause (Durham, 2016). I focused on educating the public about what hellbenders are, where they're found, why they are important, and how our actions can affect the species.

By using social media and electronic interactions you have the opportunity to reach more than just the people attending your event. As soon as I had the event information finalized, I created an event page on social media. I advertised the event and provided a platform to share information about hellbenders with my audience. You don't have to be an expert to be an advocate as long as you're passionate and have a desire to make a difference.

One way of raising awareness at the event is running a game or activity to educate and engage your attendees. My volunteers created a hellbender trivia game that addressed myths about the species and rewarded participants with candy and an information sheet for them to take home. You can ask your nonprofit if they have any educational materials available to use at the event. Help the Hellbender actually brought a Hellbender mascot costume that we were able to use for photo opportunities.

HOW TO RAISE MONEY BEFORE AND AT THE EVENT

There are numerous ways you can raise money at the event. Some venues will offer a flat percentage or a sliding scale depending on the event's actual attendance or how much is spent at the event (Hamilton, 2019). While I had initially asked the brewery I worked with for Hops for Hellbenders if they would be willing to donate $1 for each beer sold, they renegotiated that they would donate $100 as a minimum and the amount could be reevaluated after the event was held depending on attendance. I had no issue with these terms because the venue was gracious enough to host us for free.

Creating a logo is another option to help advertise and raise money through selling merchandise. Even if you're not artistic yourself, you can always reach out to others in your Chapter or even in your community to see if they would be willing to create a logo for free. I reached out to a friend in my Chapter that sells artistic commissions and asked her if she would be willing to create a logo. This logo (pg. 164) was used to make t-shirts for the event on the website Bonfire.com. You can put your logo on various merchandise, set your own prices, share a link, and have everything else done for you. The website takes care of shipping and only requires that you meet a specified number of orders to print your merchandise. After the end of the selling "campaign", Bonfire will ship everything directly to your customers and you can cash out through a PayPal account.

Silent auctions or raffles can require a lot of planning prior to your event but offer another way to raise money at your event. There are some tradeoffs and things to consider when choosing a silent auction versus a raffle. In both the United States and Canada, all types of fundraising raffles are considered games of chance (Fundraiser Help, n.d.). Due to this they are highly regulated, but raffle laws vary from state to state so be sure to check your state's legislation before pursuing a raffle. Silent auctions are more relaxed and more successful when you have high attendance. Both will require the assistance from volunteers with running the auction or selling tickets. Advertising some of your items prior to the event on social media can boost audience excitement leading up to the event and increase attendance. Even if you don't have a silent auction or raffle, it is good to have at least one representative of your Chapter present throughout the event to answer questions and take photos (Hamilton, 2019).

Obtaining items for a silent auction or raffle will follow the same process. When deciding who to request item donations from it is important to check with your Chapter and zoo to ensure you aren't asking donors or businesses that have already been asked to donate for other events. Once you've decided who you're going to ask for donations, you should create a formal request letter that can either be sent digitally, mailed, or brought to the business in person. Include who you are, your event details, why you're collecting items, and how donating can benefit them. You should also provide a donation form to be filled out that gives the business information, item description, and retail value of the donation.

To run a successful silent auction or raffle, you'll need to acquire items that will excite your audience. Animal-themed items will typically be your big-ticket items at AAZK events. Items that provide the winner an experience, such as behind the scenes tours, restaurant certificates, or tickets to local events will usually outperform material items (Classy, 2019). At Hops for Hellbenders I organized a silent auction table. All of my items (which included behind the scenes tours and tickets to the Fort Wayne Children's Zoo, various animal paintings, and animal related crafts) were obtained by reaching out to departments at our zoo, as well as asking for donations from other AAZK Chapters.

When setting up the raffle or auction table, make sure every item has a bidding sheet and pen. Also make sure you set up a designated checkout area for when it's time for winners to claim their items. Be prepared to deal with cash by having a cash box available to make change and secure the money raised. Be prepared to take credit cards by having a card reader on hand. When the event was over, I passed off all of the money raised to our Chapter Treasurer who sent the check to Help the Hellbender.

CONCLUSION

In conclusion, it is a very rewarding experience to plan an AAZK event. If you're new to your zoo and community or just looking for an opportunity to take a leadership role outside of an executive board position, planning a fundraiser can really help you become more involved and make some connections that will help long past your fundraiser ends. Never be afraid to ask for things, even if you're asking for someone to donate something for free. When you're planning an event on a budget or don't have a budget at all, every dollar counts. Don't be discouraged if someone responds "no," just be sure to be respectful no matter their answer and always thank and recognize all who support your cause.

I was proud of my first fundraising event and if I could go back and do it again there's not much I would change. We sold 97 shirts which raised over $400 and we raised almost $500 from the silent auction. My only regret is that I spent all of my time monitoring the event, the activities, and silent auction so I didn't really get the chance to socialize and enjoy all of my hard work. In the future I would have a few more volunteers or Chapter representatives to help and have designated shifts so that everyone can enjoy the event. Other tips I would give to others planning an event would be to make sure you bring twice as many pens you think you'll need and be sure to show your appreciation to everyone involved, including your attendees. My Chapter has agreed that we want to repeat this same fundraiser in the future, and I plan on continuing to help plan more events. I hope that my experience can inspire you to create your own experience and encourage you to find a new way to support conservation organizations in your community and around the world.

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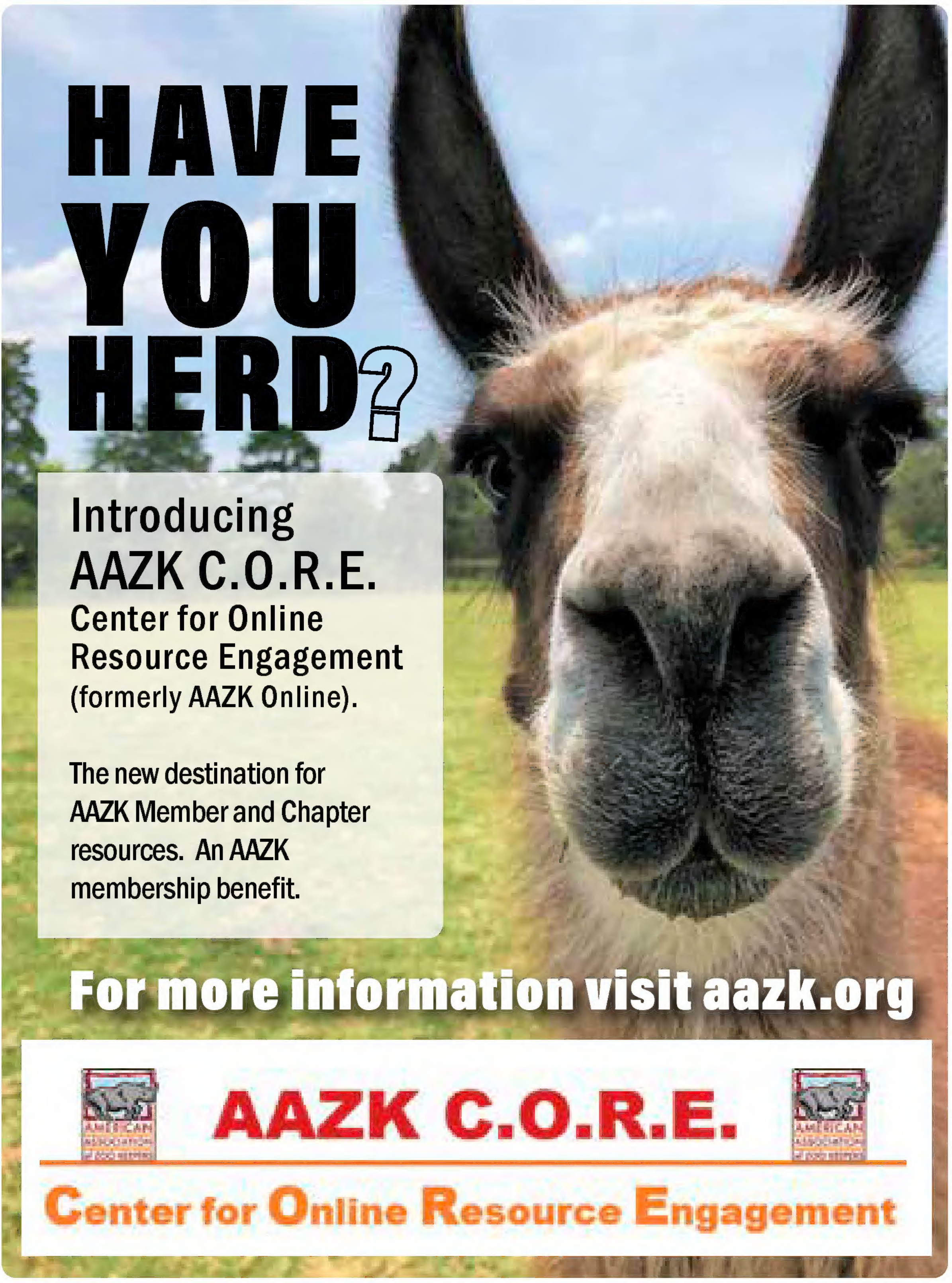

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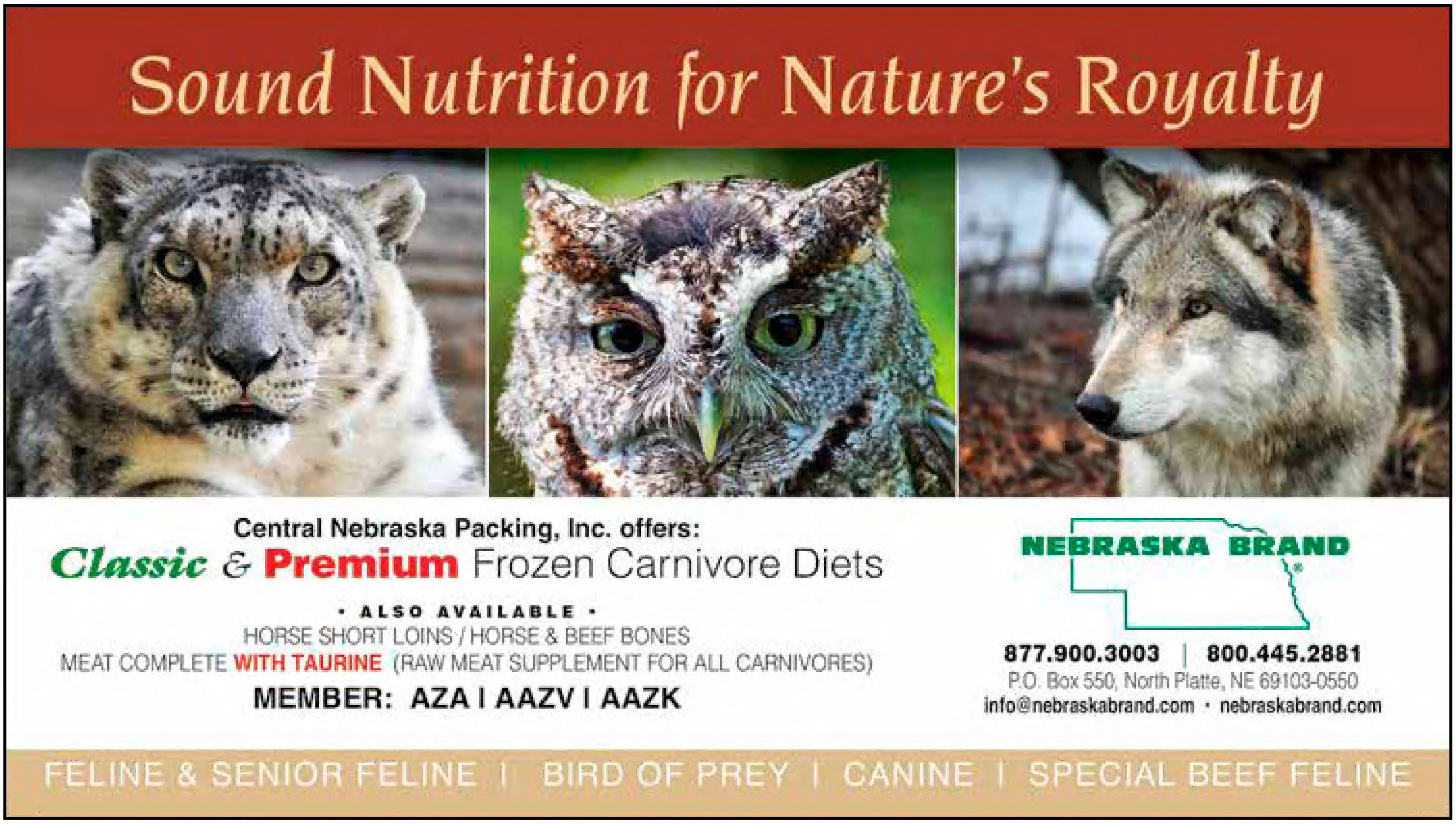
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